E8 Cancel.

isocyanate curing agent and wherein the molecular weight (MW_n) of the uncured poly(tetramethylene adipate) prepolymer is at least 6,000; and

(b) an amount of energetic plasticizer wherein the plasticizer to polymer ratio is less than about 1.6:1.

REMARKS

In accordance with the above amendments, claims 38, 43, 44, 53 and 54 (five) have been canceled and new claims 65-69 (five) added. Thus, claims 39-42, 45-52 and 55-69 remain under consideration. No claim has been allowed.

It is believed that the amendments to the claims overcome the issues raised in the Action by the Examiner pertaining to 35 USC 112, second paragraph, in Item No. 4. It should be noted that all the adipate binder polymers are recited as being cured from hydroxy terminated adipate polymers using an isocyanate curing agent. In addition, the binder combinations of the new independent claims 65, 68 and 69 recite the binder combination as "consisting essentially of". New independent claims 65, 68 and 69 respectively replace claims 38, 43 and 53 and the dependency of the corresponding dependent claims has been changed to reflect this also.

With respect to the merits of the claims, the rejection in paragraph 3 is once again respectfully traversed. While Bradford superficially describes a "low energy binder" beginning at column

1, line 61, which seems somewhat similar to the binder of the present application, that reference does not disclose or predict a particular compounds including poly(tetramethylene adipate) which in particular improve mechanical properties experienced with the material of the present invention. The same arguments apply to the other references in this particular combination. It is further noted that none of the propellants disclosed by these references has an elongation greater than 30% far less than in applicant's examples. While this is not specifically claimed in the present independent claims, it further demonstrates the lack of appreciation in the art of the superior qualities imparted by the particular claimed combination of the present invention.

The rejection of claims 43-44 and 53-54 under 37 USC 103(a) is believed rendered moot in view of the cancellation of these claims. Furthermore, claims 68 and 69 replacing these claims are believed to overcome any indefiniteness which might lead to rejection under that combination. This is also true with respect to present claims 62-64 to which the isocyanate curing agent limitation has been added.

With respect to Item 6 in which claims 38-64 were rejected under 35 USC 103(a) as being unpatentable over Sutton et al in view of Hauser et al, Godfrey and Genetti et al and Kangas,

certain comments are offered which may be, in part, a repeat of earlier remarks. Poly(tetramethylene adipate) may be referred to as PTMA.

Sutton et al does mention a preference for "carboxy-terminated, hydroxy-terminated, and isocyanate-terminated linear polyesters having a molecular weight ranging from 500 to 15,000, preferably from 5,000 to 12,000" (col. 4, lines 54-57), but they just write about polyesters in general (no specific mention of PTMA), and, in their numerous actual examples, they used only carboxy-terminated PGA with molecular weight of about 2000 and another carboxy-terminated polyester (Witco F-17-80) with molecular weight of 1550.

Hauser et al mentions PTMA as just one of many suitable polyesters (indicate no preference for PTMA). Godfrey does not even specifically include PTMA among the numerous polyesters he does list. Genetti et al lists PTMA among many other polyesters and indicate no preference for it, as does Kangas.

Although the polymer content in modern propellant binders is relatively low, it is nevertheless this small percentage of material that determines the class and type of the finished propellant. The binder network governs mechanical properties, service life, processibility, and reliability and it affects a large number of other propellant properties, such as burn rate, pressure exponent, and energetic performance. In fact, the

nature of the binder is so important in determining the properties of the resulting propellant that it has become customary in the field to actually define different propellant types by their binder types (e.g., HTPB, NEPE and PBAN propellants).

The very high elongation demonstrated in the data of the present specification were not known in any of the prior art references and these are believed to aptly demonstrate that the propellants of the claimed formulas using the presently claimed binder do demonstrate unexpected superior properties to those of the prior art. The applicant does not claim to have invented the PTMA polyester itself and understands that optimizing a result-effective variable is well within the expected ability of a person of ordinary skill in the subject art. However, it was not known before this invention that this polyester type were in among those that work could produce such a highly unexpected propellant elongation property, particularly with respect to reduced-energy binders, which traditionally have a very limited percent elongation.

In view of the above amendments, taken together with the remarks herein, applicant believes that the Examiner's objections and rejections have been met and respectfully requests reconsideration and allowance of the present claims.

If issues remain which, in the Examiner's opinion, could be

resolved by telephone interview, he is requested to contact the undersigned attorney at his convenience to discuss same.

Respectfully Submitted,

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CERTIFICATE OF MAILING

I hereby certify that the foregoing Amendment in response to the Official Action of September 10, 2001, in application Serial No. 09/088,163, filed on June 1, 1998, of John R. Moser, Jr., entitled "REDUCED ENERGY BINDER FOR ENERGETIC COMPOSITIONS" is being deposited with the U.S. Postal Service as First Class mail in an envelope addressed to Commissioner of Patents and Trademarks, Washington, D.C. 20231, postage prepaid, on December 10, 2001.

Anna C. Lemke
On Behalf of C. G. Mersereau
Attorney for Applicant

Date of Signature: December 10, 2001

MARKED-UP VERSION OF CLAIMS BEING AMENDED

39(Amended). A propellant composition as in claim [38] 65 wherein the energetic plasticizer is a nitrate ester plasticizer selected from the group consisting of nitroglycerin, n-butyl-2-nitratoethyl nitramine and trimethylolethane trinitrate and combinations thereof.

45(Amended). A reduced energy binder as in claim [43] 68 further comprising an amount of inert plasticizer.

49(Amended). A reduced energy binder as in claim [43] 68 wherein the energetic plasticizers are selected from nitrate esters of the group consisting of n-butyl-2-nitratoethyl nitramine; trimethylolethane trinitrate; triethyleneglycol dinitrate; butanetriol trinitrate; nitroglycerin and combinations thereof.

51(Three Times Amended). An improved high solid propellant composition comprising by weight:

(a) about 10% cured poly(tetramethylene adipate) [(]cured from a hydroxy-terminated adipate prepolymer Mw_n ≥6000[)] binder polymer using an isocyanate curing agent;

(b) about 11% nitroglycerin plasticizer;

(c) about 2.5% triacetin plasticizer;

(d) about 22% aluminum; and

(e) about 53% ammonium perchlorate oxidizer.

52(Three Times Amended). An improved high solids propellant composition comprising by weight:

(a) about 7% cured poly(tetramethylene adipate) [(] cured from a hydroxy-terminated adipate prepolymer, Mw_n ≥6000)] binder polymer using an isocyanate curing agent;

(b) about 6.5% n-butyl-2-nitratoethyl nitramine;

(c) about 1.4% triacetin;

(d) about 22% aluminum;

(e) about 60% ammonium perchlorate; and

(f) about 2% dicyandiamide.

55(Amended). A reduced energy binder as in claim [53] 69 further comprising an amount of inert plasticizer.

57(Amended). A reduced energy binder as in claim [53] 69 wherein the one or more energetic plasticizers are selected from the group consisting of nitrate esters of the group consisting of n-butyl-2-nitratoethyl nitramine; trimethylolethane trinitrate; triethyleneglycol dinitrate; butanetriol trinitrate; nitroglycerin and combinations thereof.

62(Three Times Amended). An improved high solids propellant composition comprising by weight:

(a) about 11% cured poly(tetramethylene adipate) [(]cured from a hydroxy-terminated adipate prepolymer, MW_n about

6,000[)] binder polymer using an isocyanate curing agent;

(b) about 12% plasticizer selected from the group consisting of nitroglycerin and trimethylolethane trinitrate and combinations thereof;

(c) about 22% aluminum; and

(d) about 53% ammonium perchlorate.

63(Three Times Amended). An improved high solids propellant composition comprising by weight:

(a) about 11.3% cured poly (tetramethylene adipate) [(]cured from a hydroxy-terminated adipate prepolymer, MW_n about 6,200[)] binder polymer using an isocyanate curing agent;

(b) about 12.2% nitroglycerin plasticizer;

(c) about 22% (30μ) aluminum; and

(d) about 53% (200μ) ammonium perchlorate oxidizer.